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maining three fingers. This anomaly was found by M. Testut on both arms of one subject. In the orang, not only are the two deep flexors united, but there is no tendon for the thumb, and this abnormality has been observed in man by Gruber, Wagstaffe, Gegenbaur, and Chudzinski. M. Testut believes that he can trace the presternal muscle, which in three or four per cent of the human subjects that have been dissected is present, and is connected above with the sterno-mastoid tendon and below to the great oblique, to the condition of things which obtains in serpents (or rather in vertebrates deprived of a sternum) in which the great oblique is attached to the mastoid apophysis. The sterno-mastoid and great oblique muscles are identical in their position with regard to the tegument, their direction, and their insertion on the haemal axial line, but where a sternum is present, the muscular fibers which descend from the mastoid apophysis find insertions upon it and upon the clavicle, and the part intervening between these insertions and what is now the great oblique becomes atrophied. Muscular anomalies are frequent in man, but M. Testut, in an important work upon this subject, shows that the muscles subject to these anomalies, which disappear entirely in some, while in others they are abnormally developed, are muscles which play an unimportant part in the human economy, and are links which unite man to the lower animals.

EMBRYOLOGY.[1]

THE DEVELOPMENT OF THE RAYS OF OSSEOUS FISHES.[2]—Since the time when Vogt published his work on the development of the salmonoids, in 1842, it has been known that the earliest traces of rays to be noticed in the fin-folds of young fishes were fine, very numerous filaments, lying parallel to each other. Th. Lotz,[3] in 1864, carried Vogt's observations farther, and thought he showed that by the coalescence of these filaments the rudiments of the permanent rays were laid down. Both A. Agassiz and myself have found these filaments in the embryo of numerous widely separated genera of teleosts; the former having also pointed out their existence in Lepidosteus. They also exist permanently in an almost unmodified form in the Dipnoans, as shown by the researches of Günther and others. Balfour and myself have found these filaments in all of the fin-folds of Elasmobranchs, though they seem to be wanting in the more fleshy pectoral of some of the Rays. They are present in the fin-folds of embryo sturgeons, and there probably give rise to the permanent osseous rays as in Teleosts, but in very young Amphibians and Marsipobranchs they are absent, and in Amphioxus the development of the so-called rays at the bases of the vertical fins is so entirely different, according to Kowalevsky's account, that they are manifestly not homologous with the homogeneous embryonic radial filaments found in the fins of true fishes (Ganoids, Dipnoans, Teleosts, Elasmobranchs and Chimæroids).

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[1] Edited by JOHN A. RYDER, Smithsonion Institution, Washington, D. C.

[2] Abstract of portion of a paper on the theory of the fins, to be published, with plates, in the Proc. U. S. Nat. Museum.

[3] Ueber die Schwanzwirbelsäule der Salmoniden, etc. Zeitsch. f. wiss. Zool., XIV, 2 Heft.

In all the forms so far made the subjects of observation, these embryonic filaments are much more numerous than the permanent rays, and appear clearly defined in sections between the mesoblast and epiblast which constitute the fin-folds when the rays are being formed, these filaments then become covered externally by a more or less clearly defined layer of mesoblast about one cell deep, or, if they are not forced inwards in this way, they coalesce directly to form the basement membrane of the permanent rays. Usually, however, they are forced inward by the radial proliferation of the mesoblast spoken of above, and they then degenerate, their substance being apparently carried out to the surface of the mesoblastic core of the permanent rays by a process of metabolism to form the basement membrane of the latter which is crescentic in sections, and immediately overlaid externally by the integument. As this new formation takes place proximally it would appear that the primitive radial filaments had coalesced by their parallel sides distally, and fused into a continuous semi-tubular strip of basement membrane which maintains its more primitive fibrillated form distally or at the margin of the fin, thus giving rise to the dichotomous structure of the right and left halves of which a caudal fin-ray is almost always composed in osseous fishes.

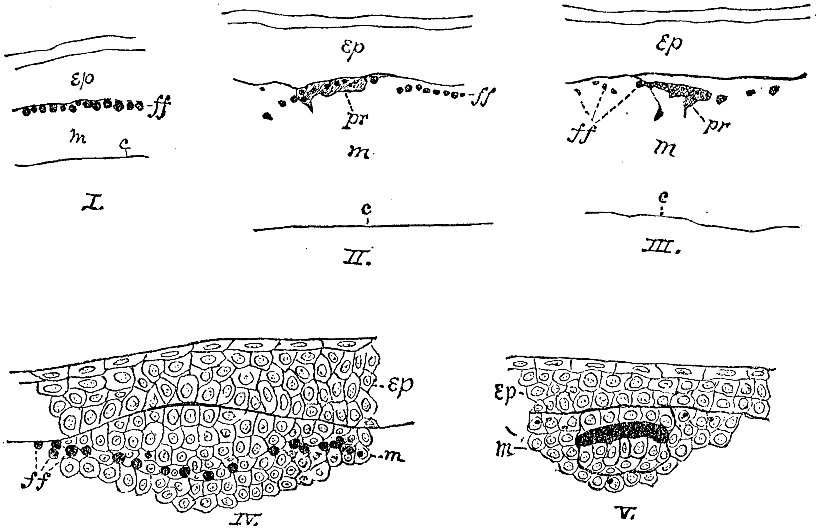
The primitive radial fibers (=embryonic fin-rays of A. Agassiz) appear first at about the end of the lophocercal stage around the end of the tail and in the pectorals. In Gadus embryos, three weeks old, the first traces of these filaments appear at the end of the tail, in the vertical fold surrounding its extremity, as numerous elongated cells with fine protoplasmic prolongations extending in one direction toward the axis of the body and in the other away from it. These spindle cells are arranged like the filamentous rays which develop later, that is, their processes extend nearly parallel to the processes of those adjacent. These rudiments of the embryonic filaments bear a remarkable resemblance to cells found imbedded in the rays of Ceratodus, as figured by Günther in his memoir on that form. I will therefore call them *pterygoblasts;* their origin is mesoblastic and not epiblastic. They develop into the embryonic radial filaments, but the extent to which these are differentiated in the median fins of Teleosts is very variable. Amongst those forms which have continuous median fin-folds developed as well as a pre-anal fin-fold, Salmo is the only form known to me which has them developed through-out the entire extent of those folds; Alosa, also a physostomous form, does not have them developed nearly so extensively at a corresponding period. In forms with discontinuous folds, as Siphostoma, for example, they are not very evident even at the time when the caudal rays are being formed, but aside from such exceptional forms they seem to be almost universally developed to some extent in the fin-folds of all truly fish-like forms except the lampreys and the lancelet.

In consequence of the striking resemblance which this stage of the development of the rays of the most specialized fishes bears to what has remained nearly permanent, with but comparatively little modification in the Chimæroids, Elasmobranchs, Ceratodus and Protopterus, I propose to call this the *protopterygian stage* of the development of the fin rays in the Teleostei. The primitive fibers in section are shown to be perfectly cylindrical and homogeneous, and so far as histological tests enable me to judge, are perfectly similar in composition to the homogeneous semitubular matrix derived from the former, in which ossification occurs to form the permanent rays. Active metabolism evidently occurs at the base of the fin-folds about the time the permanent rays are in process of development, for the reason that after the stratum of fibers becomes covered externally by mesoblast in this situation they rapidly atrophy leaving nothing but the semitubular rudiments of the permanent rays, crescentic in section, which now lie between the epiblast and mesoblast resting upon thickened tracts of the latter internally and which radiate toward the margin of the permanent caudal fin-fold; the proximal ends of these mesoblastic cores rest upon the distal end of the upturned chorda.

The segmentation of the permanent rays has not been traced, but this evidently occurs before ossification has gone very far, as it is manifested quite early in the caudal rays of certain types. It is doubtless due in part to the bendings which the rays suffer while in *use*. The rudiments of these rays are imperfectly tubular in all forms, spines also having such a form at first, though frequently these have an external layer added by coalescence with dermal plates or denticles.

The main conclusion, therefore, at which I have arrived in this investigation is the following: that it is the mesoblast which is involved in giving origin to the fibrous embryonic rays and that that layer also effects their transformation into the rudiments of the permanent rays, and not the epiderm or embryonic integument, as heretofore generally held by anatomists. The whole history of the fin-folds in fact favors such a conclusion, since the horny fibers develop between the corium and epidermis or embryonic skin, in the plane of the *protomorphic* line of Huxley. The fin-folds of embryo fishes, it should be borne in mind also, are at first wholly epidermic, the corium or true skin being only developed during the later-larval or post-larval life.

During my observations on the development of Gadus, made in 1881, I noticed a space which exists between the skin and muscle-plates (see Pl. x, Figs. 43 and 44, Contrib. Embryog. of Osseous Fishes), since then Carlo Emery[1] has published his observations founded on a study of transverse sections of the tails ot embryos of Fierasfer, Belone and Lophius, in the early lophocercal stage. In these he finds a homogeneous secretion interposed between the muscle-plates and the epiblast, extending also into



EXPLANATION OF FIGURES.

Portions of vertical transverse sections of the caudal fin of a salmon embryo, showing the development of the halves of the permanent rays of one side.

FIG. 1.—*ep*, deep and superficial layer of epiblast; *m*, mesoblast; *c*, center of mesoblastic tissue proliferated into the dermal tail fold; *ff*, filamentous embryonic fin rays cut transversely near the margin of the caudal fold.

" 2.—From a section nearer the base of the fin to show the process of fusion of the primitive rays, *pr*. The other letters as before.

" 3.—From a section in which the rudiment of the permanent ray, *pr*, is covered by mesoblast, the filamentous rays, *ff*, having been still more thickly enveloped on the outer or epiblastic side by the mesoblast than in Fig. 2. Traces of the presence of the filamentous embryonic rays can be seen in the substance of *pr* in this and the foregoing figure.

" 4.—From a section through an outer caudal ray near its base, showing the fibers *ff* enveloped externally by the mesoblastic core of the permanent ray, which forms a swelling which is cut across, on the top of which the first traces of the proximal end of the permanent ray appears.

" 5.—Section through the basal part of a median ray, the primitive fibers in the vicinity having nearly disappeared, the ray itself again becoming covered externally by proliferated mesoblast. All of the figures enlarged 365 times, the cells being shown only in the two last.

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[1] Sulla existenza del cosidetto tessuto di secrezione nei vertebrati. Att. R. Accad. Sci., Torino, XVIII, 1883.

the fin-folds, beside some scattering stellate mesoblastic cells which very possibly may be the pterygoblasts, which either themselves give rise to the embryonic rays or are indirectly concerned, together with the surrounding tissues, in pouring out such a homogeneous secretion. Such homogeneous substances I have found in other cavities in embryos, especially in the brain; in such cases I have been inclined to attribute their presence to the action of reagents, as extractive matters, as homogeneous, hardened acid-albumen, in short. The early advent of mesoblast into the fin-folds is at any rate a settled point, the stellate cells which wander outwards being mesenchymal, according to the terminology of the Hertwigs. In embryos of Scomberomorus I do not find the secretion noticed by Emery, homogeneous during the lophocercal condition, but loosely granular, more like the fine plasmic corpuscles found by me between the vitellus and zona radiata of the egg of Amiurus. At any rate I am not inclined to believe, after weighing the foregoing facts, that there is the slightest ground for the assumption that the fin-rays of fishes originate from the primary epiderm or larval integument, but that they arise from the mesoblast, as their position and first vascular supply would indicate. The distinction between the fin-rays as *exoskeletal*, from the other bones as *endoskeletal*, therefore breaks down on embryological grounds; for both are clearly of mesoblastic origin, as is further proven by the mode in which the insertions of the muscles which move the fin-rays originate.—*John A. Ryder.*

PSYCHOLOGY.

DOGS AS NEWSPAPER CARRIERS.—A very common thing on all the Connecticut railroad lines is for accommodating train men to throw newspapers off the trains at or near the houses of subscribers living on the line of the road at a distance from the stations. In many instances dogs have been trained to watch for the cars and get these papers, and country dogs, it is noticed, take quite an active interest in the affair. Over on the Naugatuck road some one has had the curiosity to inquire into this matter of dog messengers. Mr. Philip McLean, proprietor of the Gate House, on the Thomaston road, has a dog who goes a mile and a half every morning to meet the train. The paper was formerly thrown off by the brakeman on the last car, and there the dog watched for it. Lately it has been thrown from the baggage car. The dog appeared angry at the change, barked furiously, and waited sullenly for some time before going on his errand. He has not yet become reconciled to the new way of delivering his paper. Below Derby a dog has acted for several years as newsboy for a number of families. The papers are thrown out of the cars under full speed. Whether one or a large bundle of them, the dog is able to lug them off, making good time back. Another dog who has become a veteran as newsboy and cannot now, from age and rheu-